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ABSTRACT

To develop a theoretical model of the reading process of the deaf, a study was devised that tested the viability of the Goodman reading model applied to sign language and evaluated a variety of comprehension-assessing techniques to identify those that provide the most information about a deaf reader's comprehension. For the study, four deaf readers ranging in age from six through sixteen read 25 video-taped stories in sign and interpreted them. Evidence provided by cloze procedures, miscue analysis, numerous retellings, and other procedures suggest that the reading process of deaf readers closely resembles that of hearing readers as proposed by Goodman, with the following variations: deaf readers have more options available to them than hearing readers, such as fingerspelling, pantomime, and sign systems; they use graphic cues as opposed to graphophonic cues; and they are not bound to English syntax. Study results indicate that deaf readers should be allowed to read in any communication system they prefer, and should be permitted to read whole stories without interruption or preteaching. (MAI)

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A PSYCHOLINGUISTIC DESCRIPTION OF SELECTED DEAF CHILDREN READING IN SIGN LANGUAGE

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The reading of deaf children has not been adequately evaluated nor fully understood. It has long been accepted as fact that deaf children seldom achieve proficiency in reading, as Furth's widely quoted study claims (1966), but little is known about the actual degree of proficiency achieved.

Standardized tests, although criticized by a number of educators and researchers in deaf education (Hart, 1963; Babbini and Quigley, 1970; Moores, 1970; Brill, 1971), continue to be the major evaluation instruments for the reading of the deaf, in schools and in research.

Standardized test scores provide no information about the underlying process by which deaf readers attain meaning. For this reason little is known about how reading should be taught to deaf children, and there is no prevailing theory with which methods and materials can be evaluated. The results have been great dissatisfaction about reading among deaf people, educators and parents, and statements of the needs for new kinds of research (Hart, 1969; Moores, 1970; Muir, 1974).

Theoretical Framework

Descriptive psycholinguistic research has the potential for providing information about the underlying process in reading. Much of this research has taken the form of miscue studies, for which the Goodman Taxonomy (K. Goodman, 1976) or the Reading Miscue Inventory (Y. Goodman and Burke, 1970) was used.

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Miscue analysis is a procedure which requires an observable response to compare with the expected response of the text; therefore, the oral reading of the subjects has been studied. However, the speech of the deaf children in this study was unintelligible for the most part, making it necessary to focus on their use of Sign rather than oral English.

Because of their proficiency in Sign, these readers are similar to bilingual readers, and the Goodman Taxonomy and the Reading Miscue Inventory (RMI) have been used for bilingual groups, as well as for native speakers of English. Romatowski (1972) examined the reading miscues of children whose first language was Polish; Hodes (1976), the miscues of children whose first language was Yiddish; and Goodman (in process) the miscues of children whose first languages were Arabic, Hawaiian-Samoan, Navajo and Spanish. This research has provided insights into the reading process, resulting in and supporting Kenneth Goodman's model of reading.

Purpose

It was determined that descriptive psycholinguistic research, not previously used in studying the reading of the deaf, was a necessary first step to understanding the reading process of the deaf and could result in a model of that process on which future research, methods and evaluation for the deaf could be based.

Therefore, the primary objective of this study was to further test the viability of the Goodman model of reading in relation to evidence provided about the reading process of the deaf, and to develop a theoretical model of that process.

Secondary objectives were as follows:

To raise questions and identify areas of possible value for

research and to devise a taxonomy which could be used with larger numbers of deaf readers in the future.

To evaluate the effectiveness of a variety of comprehension-assessing techniques and to identify those which appeared to provide the most information about a deaf reader's comprehension.

Related Research

Standardized tests have been used to compare the reading of deaf and hearing children, with deaf children scoring lower than hearing children. Some of these studies showed that a plateau was reached by deaf children at about age ten (Furth, 1966; Gentile, 1969), or by the second year of reading instruction (DiFrancesca, 1971), after which time little progress in reading was made. Hammermeister's (1967) adult subjects showed no significant gains in scores on paragraph meaning, seven to thirteen years after completing their education.

Standardized tests have also been used to compare groups of deaf readers, particularly for the purpose of supporting one side or the other of the oral language/sign language controversy. Generally, the results have been that children who use Sign score as high or higher on these tests than those who have had only oral training ([redacted] 1968; Vernon, 1970).

Research on Isolated Variables

A major part of the reading research not involving the use of standardized tests has investigated isolated variables, such as visual perception (Olson, 1967; Blea, 1967), visual-motor skills (Clarke & Leslie, 1971), and identification of distinctive features (Hartung, 1968; McIntyre, Odom, & Byassee, 1971).

Of more value to the present research were studies which showed that deaf children make use of sign and graphic cues in reading. Doehring and

Rosenstein (1960) found that deaf children were better able to remember pronounceable trigrams than hearing children. Gibson, Shurcliff and Yonas (1970) found no difference between deaf and hearing subjects' ability to remember pronounceable trigrams and concluded that "orthographic rules are rules in their own right and apprarently can be learned as such" (p.58).

Odom, Blanton and McIntyre (1970) found that deaf children remembered words for which they had signs better than they remembered words for which no signs were available. Another study by Odom and Blanton (1970) showed that deaf children had higher comprehension scores on passages written in the order of Sign, followed by passages written in English order. Passages written in nonsense order were understood least.

Receptive Control of Written English

Several studies have shown that deaf readers do have receptive control of written English. White and Stevenson (1975) found that deaf subjects gained more information through reading than through oral language, Sign language, or total communication (the use of both oral language and Sign).

Deaf subjects showed no differences in their responses to cloze passages written by deaf and hearing persons in Cohen's study (1967), and MacGintie (1964) found that deaf subjects produced as large a proportion of articles and determiners in cloze as did hearing children.

Need for Context in Reading

It has been suggested that deaf readers cannot make use of redundancy in language as hearing readers can and that increased constraints (more context) would not make a selection more predictable for deaf readers (Cohen, 1967).

This theory was not substantiated by Marshall (1970), who found that deaf readers' cloze responses improved from sentence fragments to sentences

Table 1

SUBJECTS AND CRITERIA FOR SELECTION

Child*	Age at Beginning of Study	Hearing Loss in Better Ear (SDT)**	Age at Onset of Deafness	Language of Instruction	Age at Beginning of Reading Instruction	Years of Reading Instruction
Amy	6.11	100dB	Birth	Oral - 1 yr. Total-4 1/2 yr.	4.0	2.11
Fred	12.8	115dB	Birth or 3 mos.	Oral - 1 yr. Total-4 1/2 yr.	7.1	5.7
Jane	15.11	95dB	Birth	Oral-4 1/2 yr. Total - 4 yr.	7.0	8.11
Lisa	16.11	105dB	3 mos.	Oral - 9 yr. Total-4 1/2 yr.	6.5	10.6

*Fictitious Name
**SDT=Speech Detection Threshold

to stories, and by Odom, Blanton and Nunnally (1967), who found an increased ability among deaf readers to restore function words in cloze with an increase in the number of words provided between omitted items.

Methodology

Four deaf children--three girls and one boy--were screened for profound deafness and onset of deafness before language. Their ages were 6.11, 12.8, 15.11 and 16.11 at the time of the study. The subjects had had approximately four years of total communication, but they had had varying amounts of oral training and reading instruction. It was determined that this variance would provide a better picture of the ways in which differing linguistic backgrounds affect the reading process and would also provide a better cross-section of the deaf population. (A description of the subjects is presented in Table 1.)

TABLE 1 ABOUT HERE

Because deaf readers, like hearing readers, need the redundancy of total context, whole stories were used, rather than isolated words or paragraphs, as in most standardized tests. The four students read a total of twenty-five selections, all of which were recorded on videotape and transcribed by the researcher and three qualified interpreters.

The intent of this study was to provide as wide a variety of reading material as possible for each student at the appropriate level of difficulty. This variety would ensure that the students experience varying degrees of familiarity with style and content, thus providing insights into the effects of these factors on the readers' strategies.

There was also variation with regard to the procedures used for assessing comprehension (to be discussed) and for analyzing the data. Two stories for

each reader were chosen for miscue analysis using a modified version of the Goodman Taxonomy. Two selections judged to be the easiest and the most difficult for each reader were analyzed for percentages of fingerspelled words (symbols formed for each letter with the fingers of one hand), Siglish signs (signs which use English word order and inflections) and ASL (the natural sign language of the deaf) to determine the effect of the material on the use of these communication systems. Another form of analysis was the compilation of words which were repeated within each subject's materials to identify changes in the way these words were treated across texts.

Reading selections were examined for differences in strategies exhibited by each reader, and each comprehension-assessing activity was evaluated. The cloze procedure was also used with three of the subjects.

In addition, the subjects' language was compared to characteristics of Pidgin Sign English, as described by Woodward (1973).

Results and Discussion

This analysis resulted in the following answers to questions formulated prior to the research.

1) Do the subjects resemble native speakers of English, billingual speakers, or non-language users?

The subjects are obviously users of language. They were all capable of reading and retelling stories written in English by interpreting them into their own language. One of the subjects closely resembled a bilingual speaker; she demonstrated the most control over written English and was the most facile in interpreting it into Sign.

Two of the subjects appeared to be in a developmental stage with regard to English syntax. This was particularly noticeable in two subjects' over-generalization of the rules of English. For example, one subject signed how and added a finger-spelled L in response to the word howl. The ly suffix is sometimes fingerspelled in manual communication, and the reader over-generalized the rule by making L a suffix. The youngest subject resembled a hearing beginning reader as described by Goodman (1973) and Biemiller (1970). She had not yet integrated her use of the three cueing systems--syntactic, semantic and graphophonic. In one of the stories that was easiest for her, she used all three cueing systems but with an over-reliance on the graphic information, signing cat for cart and frog for front. At the beginning of her most difficult story, she made syntactic and semantic predictions with little use of the graphics, as in the following example:

cry look(for) where is home
The boy did not want to go into the woods.

By the end of that story, she may have been unable to put together the meaning of the story from all her miscues and therefore began to rely on graphics again, as shown by her omissions and fingerspellings. She used omission to avoid risk-taking while the older readers used fingerspelling to some extent for that purpose.

2) Is reading an ideographic, symbol-by-symbol process for the subjects rather than an integrated use of the three cueing systems as in the hearing reader? What, if any, cueing system is substituted for the phonic system for these readers?

The highest mean percentage for these readers was in syntactic acceptability (71.88), followed by minimal or no meaning change (69.13), semantic acceptability (57.63), and graphic similarity (36.88). These averages of syntactic and

semantic acceptability measures are very high, showing that the readers made extensive use of these two cueing systems. The lower scores for graphic similarity show that the readers did not over-rely on graphic information. For the hearing reader, the graphic cueing system is partially based on graphic-phonic relations; the deaf reader may be making grapho-sign associations. For example, one reader signed know for think. These signs share two characteristics in common. They both touch the forehead (tab) and they both involve the same movement (sig). The two signs differ only in the dez (hand configuration) -- designations made by Stokoe (1976). A similar phenomenon was found by Bellugi, Klima and Siple (1975) in a study of deaf subjects' recall. However, more information about the sign-similarity phonomenon in reading is needed.

3) To what extent is the semantic cueing system dependent upon English syntax for these readers?

A mean of 20 percent of the semantically acceptable miscues of these readers was syntactically unacceptable. In addition, two subjects demonstrated a "chaining complex" (Vygotsky, 1962) which resulted in responses which had a semantic relationship but which had a different grammatical function than the expected response as in the following example:

(HE) 2. blue
1 black

When the boys and girls got back to school.....

While these readers did exhibit good control over many aspects of English syntax, it is suggested that the readers were also capable in some instances of by-passing the syntactic deep structure and moving directly to meaning.

4) What is the relationship between comprehending and comprehension for these readers?

The relationship between the measures of retelling scores and comprehending scores (the percentage of semantically acceptable or corrected miscues) varies considerably according to the group under investigation. Goodman's 1973 study found a moderate positive correlation in the reading of monolingual subjects, while Hodes' 1976 study of bilingual Yiddish-English speakers found a great discrepancy between the mean retelling score and the mean comprehending score.

Two factors which prevent these scores from having a perfect correlation are the silent-correction phenomenon and the possibility that the subjects do not always choose to tell all that they know about a story. Nevertheless, the deaf readers' mean comprehending score was only 5.5 points lower than their mean retelling score, suggesting that the analysis of miscues and the scoring of retellings were reliable measures of assessment for these readers.

5) What similarities and differences exist between the reading strategies exhibited by these readers and the strategies used by hearing readers?

There were more similarities than differences between the two groups. One strategy of the efficient hearing reader is to substitute a place-holder for unknown words rather than make repeated attempts to pronounce them. One subject showed efficient strategies in her substitution of the place-holder, thing, for projects, a sign she did not know, and her omission of the last name of the character, Jan Jannssen. Reading his last name each time it appeared would have involved repeated fingerspelling of the difficult name.

Inefficient readers who are overly concerned with precise reading tend to over-correct, and overcorrection was a strategy of one of the deaf readers. Both hearing and deaf readers may use the correction strategy when miscues do not make sense, but meaningful miscues do not need to be corrected.

Ineffective hearing readers, or proficient hearing readers encountering material which is too difficult, tend to pay closer attention to the graphic information. These deaf readers did the same, as shown by the increase of fingerspelled words (an increase of about 4 words per hundred) from the easiest to the most difficult story read by each subject.

The major difference between the strategies of deaf and hearing readers is that deaf readers have the option of fingerspelling an unknown word where hearing readers might produce a non-word. In neither case, however, can it be assumed without further evidence that the concept has not been grasped.

Deaf readers sometimes use a clarification strategy, which has not been identified in the reading of hearing bilingual subjects. Deaf signers, especially in conversation with hearing people, will often clarify certain concepts by signing and then fingerspelling them or adding pantomime, or using both the ASL and the Siglish sign, or any combination of these communication systems. Examples follow:

CS 2. laugh (different sign) 1. lot of laughter (ASL)
The other princes roared with disdainful laughter.

CS 2. Carol (fingerspelled) 1. Girl (signed)
Carol and her mother went to the store.

Perhaps because of their greater difficulty in communicating with hearing people, even their own parents in many cases, deaf children have a stronger need to assure themselves that they have been understood.

6) What language-specific phenomena are exhibited by these readers? What evidence is there of the influence of various sign systems on the reading of these subjects?

The subjects' language in the school setting appears to be a pidgin, made up of signs from various Siglish systems and ASL. They displayed different style levels, depending upon their perceptions of the formality required by the task. Their language also showed variation in the use of some signs, which may have been due to the linguistic environment. More information is needed about Sign pidgins and linguistic constraints on choices within the language.

The only phenomenon exhibited by these readers which is specific to manual communication is the greater range of choices which deaf readers have in response to written English. They can use the various systems of Siglish, ASL, pantomime, voice, and fingerspelling, and they also have the options available to hearing readers--dialect, ideolect, and omission.

7) Do these subjects develop concepts through reading? Do they acquire new syntactic patterns?

Because some words appeared several times in one story or in more than one story read by a subject, it was believed that an examination of the treatment of these words by the readers would provide evidence that concepts had been attained through the repetition of related ideas in the reading and that fingerspelling was used primarily for unknown concepts.

The readers provided evidence that fingerspelling was used for unknown concepts. For example, one reader moved from repeated fingerspellings of genius through a story to the sign for smart the last time it appeared. Another reader fingerspelled away in one story and signed it in the next story.

Evidence for the accumulation of meaning through reading was provided by examples like the above and in other words which were repeated throughout the stories. One reader encountered the word typical thirteen times in one story. The first two times she signed type, meaning to use a typewriter; then she signed office, chaining from her first miscue. She then signed type three more times, then fingerspelled typical, misspelling it, then fingerspelled it correctly five times. The last time she encountered the word, she signed group, showing that she now understood the concept.

That the subjects also acquired new syntactic information through reading was suggested by improved second readings, one subject's better cloze performance on materials with repeated syntactical patterns, and one subject's responses to cloze which seemed to have been learned from the material being read. Much more information is needed, however, before a definitive statement can be made about the development of syntactic patterns through reading.

8) Since the subjects' language is predominantly Sign rather than English, do they use an intermediate process to bridge the gap between the meaning and the written English sentence? Or do the subjects assign meaning directly, using their experiential and linguistic backgrounds?

The most proficient reader in this study seemed at times to be able to move directly from the graphic information to the meaning, by-passing the syntax. This was demonstrated in her pantomiming and in her chained responses. The extent to which the English syntactic cueing system had any effect on that move toward meaning and the extent to which some syntactic structure in ASL or mime was involved is not known, but the response was often not syntactic by traditional standards of acceptability and was often not the same grammatical function as the expected response. Therefore, it would seem that the syntax

does play an important role in their reading unless a passage is so predictable that the proficient reader can bypass syntax and move directly to meaning.

9) To what extent do English idioms and specific types of English sentence patterns affect the acquisition of meaning for these subjects?

Complexity of sentences seemed to have some effect on the reading of the second story coded for each reader, but the scores were not greatly decreased because of them, and the profiles of the readers' use of the cueing systems remained about the same. Retelling scores decreased for one subject and increased for another. More research is needed to determine the actual effect of sentence complexity on the reading of individuals at varying levels of proficiency.

Certain English idioms seemed to have had a negative effect on one subject's cloze responses, but idioms were not isolated and studied in other selections which were read. It is probable that control of English idioms is highly idiosyncratic, and, further research into the reader's ability to acquire new concepts and new syntactic patterns through reading would be of more value than a study of the effect of specific English idioms.

10) To what extent is fingerspelling a legitimate representation of a concept? Is it the equivalent of hearing children's "sounding out" of words to which they can attach no meaning?

While fingerspelling was often used as a place-holder for an unknown concept, it could also have been in some instances a legitimate representation of a concept. Fingerspelling did increase with the difficulty of the material,

but this increase, especially for more advanced readers, could partially reflect an increasing number of English words for which a sign was not known, even though the concept was understood. Deaf readers sometimes prefer the fingerspelling to the sign, and some fingerspelled function words have almost become signs in their own right because the hand configurations and movements are so easy and familiar.

More fingerspelling occurred in the readings than in the retellings. This could be due to less risk-taking in the reading or avoiding of unsignable words in the retelling.

11) What are the most viable assessment procedures for the comprehension attained by these readers?

In addition to the retellings, seven other types of activities were used to assess comprehension and to determine the viability of those activities.

While the cloze activity provided a great deal of information about comprehending (the understanding which the reader exhibits in the act of reading), it did not provide a great deal of evidence for comprehension (the cumulative result of the reading of the whole selection). The readers did not give as much information in the retelling of the cloze as they did in other retellings. This was judged to be the result of the readers' greater reluctance to take risks in retelling material from which certain cues were omitted.

Other activities - matching story characters with their characteristics, finding similarities among stories, and DRTA (predicting the next event, Stauffer, 1971) - were judged to be effective if combined with retelling of the story and discussion.

Writing about the subject prior to and following the reading could have some value for reading in the content areas, and following directions is useful, if children are given sufficient experiences with the abbreviated language of directions.

All the activities provided some insights into the readers' concepts and language, but the retelling procedure was found to be the best comprehension-assessing technique.

12) Do these readers exhibit inferences and misconceptions in their retellings?

All the readers exhibited inferences and misconceptions. Misconceptions were classified as being primarily attributable to two factors - limited linguistic and life experience and the influence of prior knowledge. Misconceptions and inferences demonstrated the subjects' interaction with the information in the story and their willingness to take risks.

Proposed Model of Reading Process of the Deaf

The primary objective of this study was to develop a model of the reading process of the deaf. From the data obtained it was possible to develop such a model. The model is a theoretical inference from the data analyzed in the reading of only four subjects. However, it can be used as a basis for future studies. This research was based on the theoretical model developed by Kenneth S. Goodman (1976), which in turn was generated by his miscue research. Therefore, it is necessary to begin with that model to test its viability in relation to the reading of these deaf subjects. A somewhat simplified explanation of the cycles in the Goodman model and observations about deaf readers in relation to these cycles follows.

Start

The reader recognizes the task as reading a known language. This recognition is stimulated by the graphic display and the reader's memory of prior displays, and it results in the reader's scanning the graphic information.

While the language of deaf readers is different from English, it is not a written language and therefore, English orthography is used. The subjects live in a culture which displays English orthography on every hand. They make use of English orthography by interpreting it into Sign, as seen in their semantically acceptable miscues and their substitutions of ASL signs for English words. On one occasion one subject seemed to be confused by the orthography, not recognizing it as English. This was due to the author's having written a word in eye dialect in an attempt to represent the phonology of the speaker in the story ("Not dang'rus"). After giving the researcher a puzzled look, the reader fingerspelled the word, omitting the apostrophe.

Optical Cycle

The reader scans in a left-to-right direction in English texts, relying on the memory of that left-to-right orientation and adjusting the speed of the scan to the speed at which the information can be processed. This results in an optical fixation cycle, in which the reader focuses the eyes on specific points in the text. These points are determined by the reader's prior predictions and the reader's expectations of where key graphic information will be found.

In the case of fingerspelling by the deaf reader, it might be said that fixations are made more often so that individual letters are in focus rather than larger graphic units. However, if the reader has chosen to fingerspell a known concept because there is no sign or because the reader prefers to fingerspell the word, it is doubtful that each individual letter is brought into focus. On the other hand, if the concept is not known, fingerspelling might involve focusing on individual letters.

Perception Cycle

The reader samples from the graphic display in sharp focus and in the periphery, choosing those cues which will confirm or deny prior predictions. These cues are stored in the memory for feature analysis, in which the reader assigns the print to a particular style (such as cursive or manuscript) and chooses features necessary to decide between alternate letters, words or structures. This analysis results in a confirmation of the prediction, a correction by rescanning and making new fixations, an attempt to make a close approximation, or a decision to terminate the cycle. If prior predictions are confirmed, the reader moves to an image-formation process in which a comparison is made between what was seen and what was expected and new cues are chosen which will fit with prior predictions. If an image is formed at this point, the reader moves on to the syntactic cycle.

These readers showed some evidence of having pulled graphic information from the near periphery. Their percentages of high graphic similarity also show that they made use of graphic information.

The sign similarity phenomenon might present itself at this point in the cycle. The deaf reader at the image-formation stage might attempt to match graphic input and expectations with known signs in an effort to form an image.

Syntactic Cycle

The reader assigns an internal surface structure to the syntactic unit drawing from memory previously established rules of English grammar, prior syntactic and semantic predictions, and perceptual images formed in the preceding cycle. If no structure is possible, the reader returns to the perception or the optical cycle. If the assigned structure is inconsistent with the information in the memory, the reader tries an alternate structure or goes back to the previous cycles. If the structure is possible, the reader assigns a deep structure from the internal surface structure previously assigned, as well as from prior predictions and from a knowledge of transformational rules. Again the reader may seek alternatives, recycle, or terminate if no deep structure can be assigned or if the deep structure is inconsistent with predictions. If the assigned deep structure is possible, the reader predicts graphic, semantic and syntactic features, assigns appropriate intonation, and goes to meaning.

At the stage where the reader assigns an internal surface structure, the deaf reader has more options than the hearing reader. Not only are English alternate options available, but also a wide range of communication systems with which to represent the surface structure. At the point where the hearing reader assigns a deep structure the deaf readers also sometimes assigned deep structures, as evidenced by their miscues which had a different English deep structure and by their cloze responses which had the same grammatical function as the expected response. But the deaf readers also had the further option of by-passing the deep structure by producing literal translations or fingerspelling to maintain the grammatical function and keep the English sentence intact. While the hearing reader assigns an intonation contour on the basis of syntax, the deaf readers seemed to add vocal intonation primarily for additional meaning (such as stress for an italicized

word) rather than as an obligatory addition to the syntax.

Construct Meaning

The reader decodes to meaning by using the deep structure, prior predictions, and stored experiences, concepts and vocabulary. Once again the reader has the options of recycling, terminating, or assigning alternates when meaning is not gained. If meaning is gained, the reader moves to the final stage of the process in which the meaning is assimilated or accommodated into the reader's existing semantic structures.

The deaf reader who has used fingerspelling or literal translation as a place-holder in the surface structure might at this point move to meaning, as exemplified by partially fingerspelled words which were abandoned for the appropriate sign. That the deaf reader is able to by-pass the deep structure is exemplified by the use of pantomime and by the percentage of miscues which were semantically acceptable but syntactically unacceptable. The chaining miscues and attempts at words repeated across texts showed some understanding of the concept but did not often preserve the grammatical function of the expected response or the syntax of the sentence.

Meaning may not be reached immediately, however, and the concept may remain in abeyance. The natural redundancy of the English language and the redundancy of a well-written story often provide a semantic build-up which results in the reader's grasping the concept at a later point or gradually acquiring the concept through the course of reading.

That these readers were able to decode to meaning is evidenced by their semantically acceptable miscues and their identical responses in cloze. The deaf reader appears to add the appropriate meaning intonation at this level.

The final stage of the process, assimilation or accommodation, was made evident not only by the comprehending scores of the deaf readers, but also by their retellings. One subject had a misconception that a retarded boy in one story was a teddy bear, based on her knowledge of the name Teddy and the information given in the story, which did not strongly refute that idea. This is a good example of assimilation of new information into existing categories. Another subject accommodated new information about the verb make when she learned that it did not mean to write the word but to draw the object.

Breakdowns and Short-Circuits

Unsuccessful predictions can also be explained in terms of the model. Figure 1 presents the models and the short circuits which may cause a breakdown in the effectiveness of the reading of deaf people.

A major breakdown would occur at any point where the reader ceases to be an active participant in the reading process, as shown by one subject's difficulties with silent reading. Other breakdowns occur as the result of over-attentiveness to graphic information, due to difficulty of materials or too much concern for precision in reading. English idioms unknown to the reader could cause a breakdown in the syntactic or the semantic cycle.

Over-correction, which is an indication of a view of reading as a precise process, presents evidence of a short-circuit which moves the reader away from meaning and back to graphic information. The use of Siglish signs which are not an inherent part of the language system of the reader could cause the reader to by-pass meaning and leave the reader back at the surface-structure part of the cycle.

The only productive short-circuits are those which by-pass syntax and go directly to meaning. These include pantomime, syntactically unacceptable but

FIGURE 1

COMPARISON OF GOODMAN MODEL AND PROPOSED MODEL OF READING PROCESS OF THE DEAF

Cycles in Goodman Model	Proposed Reading Model of Deaf	Breakdowns and Short-Circuits
Start: Recognize task as reading known language.	Start: Recognize task as interpreting English orthography into known language	Difficulties with eye dialect could cause breakdown here.
Optical Cycle: a. Scan in direction of print display.	Same as Goodman Model	
b. Fix-focus eyes at point in the print.	Same as Goodman Model	Eye could focus on individual letters if fingerspelling unknown word. here
Perception Cycle: a. Sample-Select. Choose cues from available graphic display.	Same as Goodman Model	Difficult syntax and content could cause breakdown here, resulting in fingerspelling or omissions. Reader could also use fingerspelling as place-holder and move eventually
b. Feature Analysis. Choose features necessary to decide among possible letters, etc.	Same as Goodman Model	Feature analysis of sign pictures caused breakdown here. Decision to Fingerspell could take reader back to here
c. Image Formation. Form image of what is seen and expected to be seen. Compare with expectations.	Might include comparison of signs to graphic information.	Chaining and mime show short-circuit from here,
Syntactic Cycle a. Assign internal surface structure.	Assign internal surface structure from wider range of options.	Inability to generate surface representation could lead to Over-corrections short-circuit from here English idioms could cause breakdown here, and leave reader here
b. Assign deep structure. Seek clauses and their interrelationships.	May assign English or ASL deep structure. If deep structure assigned, move directly to meaning.	here, Use of Siglish could cause short-circuit here
Assign appropriate intonation contour.	May assign intonation here.	
Construct Meaning a. Decode	Decode or retain surface structure features until further information obtained.	or here. to here, by-passing syntax. or here, back to
	Add appropriate intonation for meaning.	
b. Assimilate/ Accommodate	Assimilate/Accommodate (May include information not decoded during previous cycles.)	to here. pantomime or syntactically inappropriate but meaningful miscues here.

semantically acceptable miscues, and substitutions of inappropriate English inflections which do not appear to lose meaning. (Romatowski's study also raised the question of the semantic acceptability of substitutions of inappropriate inflections, 1972).

Implications for Instruction

This study has provided insights which should be of value to teachers of the deaf.

1) Standardized tests are neither valid nor reliable for evaluating the reading process, and reading instruction must be based on an understanding of that process.

2) The ability to provide the appropriate label for a word or concept does not ensure that the word or concept has been understood; nor does the inability to provide a label prove that there has been no understanding.

3) Meaning, not precision, is the goal of reading, and miscues must be evaluated in terms of quality rather than quantity.

4) Deaf readers who are able to read in their own language are exhibiting strengths rather than weaknesses.

5) Reading instruction should be firmly grounded in a sound theoretical base. Psycholinguistic research has provided such a base.

6) Deaf children should be allowed to read in any communication system that they prefer. The child's language should not be corrected during reading.

7) Whole, meaningful, interesting, and predictable stories should be used for reading instruction. Deaf children should not be expected to read isolated words or sentences.

8) It is better to assess deaf readers' comprehension following the reading than to question them about individual concepts before they have had

the opportunity to accumulate meaning through the whole story.

9) It is important to consider not only the answers which deaf children give in response to a question but also the children's reasoning which brought them to that answer.

10) The unaided retelling procedure followed by careful, open-ended questioning appears to be the best comprehension-assessing procedure for deaf children.

11) The Directed Reading-Thinking Activity (DRTA) seems to be an effective technique for focusing deaf readers' attention on meaning.

12) Teachers of the deaf should prepare the students for reading by giving them actual experiences which will help them to deal with new concepts. This is particularly important in introducing content materials. However, preteaching language structures and specific vocabulary may not be as necessary as is currently believed.

13) Comparison of the treatments of content words across texts could be useful for teachers in determining their students' grasp of concepts and in finding habitual associations which could be interfering with meaning.

14) Teachers should be aware of overcorrection and other strategies which take readers away from meaning and should encourage their students to correct only those miscues which cause a loss of meaning.

15) Teachers should not overlook the readers' use of voice in reading when the student chooses to use the voice and when the speech is intelligible.

16) Teachers should know the language of their students well so that they will be able to make informed decisions about the acceptability of each reader's use of fingerspellings, Siglish signs and ideolect.

17) Because of the necessity for understanding the language of the children, deaf teachers should be hired to teach deaf children whenever possible.

18) Above all, teachers should respect the strengths exhibited by their students and build on these strengths rather than disparaging their weaknesses.

Recommendations for Future Research

Because the Goodman Taxonomy with minor revisions has proved to be a viable instrument for coding the miscues of deaf readers, it is recommended that this instrument be used in studying the reading of a larger deaf population for the purpose of further testing the proposed reading model of the deaf. In addition, research using the Reading Miscue Inventory could determine the feasibility of its use by teachers of the deaf.

Developmental studies of beginning deaf readers are needed as well as longitudinal studies for the purpose of identifying changes in strategies over a period of time.

Specific research ideas suggested by this study include the following:

Further study of sign similarities and clarification strategies in reading and comparison of these to the same phenomena exhibited in signed conversation

Studies of the deaf child's ability to acquire rules of English grammar and syntactic patterns through reading

Studies of the dependency of semantics upon syntax for deaf readers

Further studies of the relationship between fingerspelling, concept density, and syntactic complexity for deaf readers

Investigation of the relationship between the use of ASL signs and comprehension

A thorough study of Pidgin Sign English and other sign systems which have developed within deaf communities

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